भारतीय मानक

IS 12468 : 2023

Indian Standard

बड़े पैमाने पर कंक्रीटिंग के लिए निमज्जन प्रकार के कम्पित्र — सामान्य अपेक्षाएँ

(पहला पुनरीक्षण)

Immersion Vibrators for Mass Concreting — General Requirements

(First Revision)

ICS 91.220

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भारतीय मानक ब्यूरो
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April 2023 **Price Group 5**

Construction Plant and Machinery Sectional Committee, MED 18

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Mechanical Engineering Division Council.

The compaction of concrete by vibration has revolutionized the concept of concrete technology, making possible use of low slump stiff mixes for production of high quality concrete with required degree of strength, density, durability and impermeability. Immersion vibrators (also called internal vibrators) are most commonly used for compaction of plain and reinforced concrete. Immersion vibrators up to 90 mm in diameter are inadequate for mass concreting work, especially while taking into account the speed of pouring of concrete. In mass concreting, aggregates of sizes up to 150 mm are used. Effective compaction cannot be obtained with smaller diameter needles and as such, it has become necessary to use bigger diameter needles. This standard is being prepared for giving guidance in the manufacture and use of immersion vibrators of needles of diameter over 90 mm. Immersion vibrators of 90 mm and below have already been covered in IS 2505.

Electric high frequency vibrators with convertors having multipoint output with built-in motors in vibrator head are considered to be advantageous for higher diameters and ensure high range of action and efficient operation. Use of petrol/diesel engine prime mover is unsatisfactory in view of the weight due to higher horsepower rating of the unit. For safety reasons, the use of high frequency, low voltage electrical drive units is recommended for these vibrators.

This standard was first published in 1988. This standard is being revised again to keep pace with the latest technological developments and international practices. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references of Indian Standards, wherever applicable have been updated. Bureau of Indian Standards certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act*, 2016. The following major modifications have been incorporated in this revision of the standard:

a) New terms and definitions have been added;
b) Classification and structure of immersion vibrators have been added;
c) An instruction sheet containing instructions relating to installation, commissioning, use, maintenance, operation, lubrication of the vibrator and prime mover, transportation, handling and storage has been added; and
d) A new clause regarding the information to be supplied by the manufacturer has been added.

The composition of the committee responsible for the formulation of this standard is listed in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

Indian Standard

IMMERSION VIBRATORS FOR MASS CONCRETING — GENERAL REQUIREMENTS

(First Revision)

1 SCOPE

This Indian Standard lays down classification and requirements of material, size, construction, and performance of immersion type vibrators above 90 mm size suitable for mass concreting.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to the agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No.	*Title*
IS 1030 : 1998	Carbon steel castings for general engineering purposes — Specification (*fifth revision*)
IS 1161 : 2014	Steel tubes for structural purposes — Specification (*fifth revision*)
IS 1239 (Part 1) : 2004	Steel tubes, tubular and other wrought steel fittings — Specification: Part 1 Steel tubes (*sixth revision*)
IS 1570 (Part 2) : 1979	Schedules for wrought steels: Part 2 Carbon steels (unalloyed steels) (*first revision*)
IS 2505 : 1992	Concrete vibrators — Immersion type — General requirements (*third revision*)
IS 15999 (Part 1) : 2021/IEC 60034-1 : 2017	Rotating electrical machines: Part 1 Rating and performance (*second revision*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2505 and the following shall apply:

3.1 Driving Shaft — A shaft which connects the motor and the eccentric shaft, and gives the drive to eccentric shaft.

3.2 Driving Gear — A gear on the motor output shaft and the eccentric shaft.

3.3 Spindle Coupling — Coupling which connects the eccentric shaft and the motor gears through the spindle tube.

3.4 Spindle Tube — A tube which encloses the drive shaft.

3.5 Upper Eccentric Housing Cap — Cap which is on the driving end of the vibrator and connected to the spindle tube.

3.6 Vibration Head — Vibrator comprised of a vibration generator that is immersed in the concrete mix for the purpose of its compaction

NOTE — The vibration head typically has a cylindrical form and its end is adapted for coupling a driving unit or power network.

3.7 Flexible Drive Shaft — Component made of flexible material or of segments that transmit rotary motion from a power source to a vibration head.

NOTE — Since the drive shaft may also be used as a handling medium, it will typically have a protective shroud that permits the shaft to rotate within the shroud.

3.8 Protective Hose — Medium used to hold the insulated electric motor or the hose carrying compressed air to the pneumatic motor in the vibration head, and which will incorporate appropriate protective devices or mechanisms.

3.9 Compaction Diameter — Diameter of an area corresponding to an extent of the measurable action of compaction during the vibrator's operation.

NOTE — The compaction diameter will depend on the vibrator's parameters, the concrete mix composition and the time of compaction.

3.10 Frequency and Voltage Converter — Unit used for the electric supply of an immersion vibrator with a frequency higher than that supplied by the power network and, if included, safety voltage.

3.11 High and Normal Frequency Generating Set — Unit composed of an internal combustion engine, electric generator and frequency converter.

4 MATERIALS

4.1 The tube of the vibrating needle shall be of seamless steel tube or heavy class ERW tube conforming to IS 1161 or IS 1239 (Part 1).

4.2 The bottom cap shall be of carbon steel of grade 35C8 of IS 1570 (Part 2) and shall be tempered and hardened to 40 HRC to 50 HRC.

4.3 The eccentric shaft/rotor shall be made of carbon steel of grade 35C8 of IS 1570 (Part 2) and shall be tempered.

4.4 Bearings

The bearings shall be of ball bearing type of suitable capacity and conforming to relevant Indian Standards.

4.5 Drive Shaft

The drive shaft shall be made of seamless tube with end coupling of carbon steel with internal gear teeth for coupling to the eccentric shaft end and motor end.

4.6 Handle

It shall be of mild steel with rubber covering to suit the site requirements.

5 CLASSIFICATION AND STRUCTURE

Immersion vibrators shall be classified according to its type (eccentric or pendulum, flexible drive or built-in motor types) and power source used for operation.

5.1 Immersion Vibrator with Flexible Drive

Vibrator with drive transmission from prime mover to vibration head in the form of a flexible drive shaft.

NOTE — The drive shaft may be enclosed within an outer sheath to permit handling during use.

5.1.1 *Electric Immersion Vibrator with Flexible Drive*

Vibrator in which the drive for the vibration generator is composed of an electric motor with a flexible drive shaft to the vibration unit.

NOTE — The drive shaft may be enclosed within an outer sheath to permit handling during use.

5.1.2 *Combustion Engine Immersion Vibrator with Flexible Drive*

Vibrator in which the drive for the vibration generator is composed of an internal combustion engine with a flexible drive shaft to the vibration unit.

5.2 Built In Motor Type Electric Immersion Vibrator

Vibrator in which an electric motor and the vibration generator are both enclosed in the vibration head. It can be classified as either an external converter type or integrated converter type.

NOTE — Typically, it is composed of a frequency and voltage converter, protective hose, and control box with contactor.

5.3 Hydraulic Immersion Vibrator

Vibrator comprised of a rotating eccentric mass directly coupled to a hydraulic motor to produce a stable and powerful vibration.

NOTE — The method of control typically enables precise regulation of frequency. These units are usually designed for use in the production of large concrete elements with large aggregate.

5.4 Pneumatic Immersion Vibrator

Vibrator using compressed air and provided with a vibration head comprising a pneumatic motor.

NOTE — Typically, it is composed of a vibration head, protective hose (incorporating air supply) and twist grip throttle control.

5.5 Eccentric Type Vibration Generator

Mechanism generating harmonic vibration by the eccentricity of mass rotating inside the casing in bearings.

5.6 Pendulum Type Vibration Generator

Mechanism generating vibration with a pendulum by rotating an out of balance mass along a circular path.

5.7 Flexible Type Structure

Vibrator comprising a flexible shaft or protective hoses for pneumatic and hydraulic designs and a flexible conductor for supply.

5.8 Holding Type Structure

Vibrator equipped with a handle.

6 SIZES

6.1 The size of the vibrator shall be denoted by the outside diameter of the vibrating needle and expressed in mm.

6.1.1 The actual outside diameter of the needle measured anywhere in its length excluding the bottom cap and top tube shall not differ from the outside diameter by more than ± 2 mm.

6.1.2 The standard outside diameter of the vibrating needle shall be 100 mm, 110 mm, and 150 mm. Other sizes exceeding 90 mm and up to 150 mm may be as agreed between purchaser and manufacturer.

6.1.3 *Length of Vibrating Needle*

The length of vibrating needle shall be measured from the outer end of the bottom cap to the joint between the needle casing and the upper eccentric housing. Tolerance of the length shall be ± 5 mm.

NOTE — The standard lengths of 600 mm, 625 mm, and 650 mm are recommended for selection of suitable length depending upon the nature of jobs required. These sizes have been recommended arbitrarily, purely with a view to aiding rationalized production by limiting a number of sizes.

7 CONSTRUCTION

7.1 Vibrating Needle

7.1.1 *Tube*

The tube should be reinforced at the threaded portion as indicated in Fig.1 to prevent any failure due to lesser thickness at this point. Suitable bearing blocks have to be welded inside the tube for mounting the bearings of the eccentric shaft. This is necessary because the outer diameter of the bearings of the required capacity may be less than the inside diameter of the needle casing (*see* Fig.1).

7.1.2 *Bearings*

These shall be of adequate size, and suitably mounted and press fitted on the shaft so as to take both radial and axial loads. The bearings and the eccentric shaft assembly shall be such as to enable the removal of shaft for repairs and replacement.

7.1.3 *Concentricity*

The eccentric shaft or rotor upon assembly shall be such that all components are concentric about their respective centre lines where bearing, journals, housing and drive shaft, etc, are concerned.

7.1.4 *Vibrating Needle*

It shall be completely sealed against entry of moisture, dust, grout, etc.

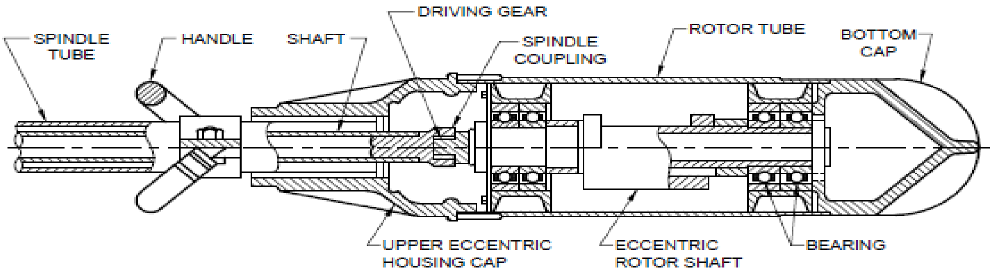

FIG.1 HEAVY DUTY VIBRATOR

8 PERFORMANCE REQUIREMENTS

8.1 It shall be in accordance with IS 2505 excepting that the frequency of vibration and amplitude should be as follows:

Sl No. (1)	*Diameter of Vibrating Needle* (mm) (2)	*Frequency (Vibrations/minute)* (3)	*Amplitude* (mm) (4)
i)	100	5 500 – 8 500	2.1
	110		
	150		

8.1.1 The normal recommended life of unit is 5 000 h except for the wearing parts.

8.2 Centrifugal Force

A vibrator's prime mover shall be sufficient to drive the device, without losing speed, such that the declared centrifugal force is maintained continuously under the maximum load of intended use.

8.3 Rating Time

The rating time of a vibrator shall be continuous according to IS 15999 (Part 1).

8.4 Current and Power Consumption

The current and power consumption of the electric vibrators, when subjected to a normal load shall comply with data declared by the manufacturer.

9 INSTRUCTION SHEET

9.1 An instruction sheet containing instructions relating to installation, commissioning, use, maintenance, operation and lubrication of the vibrator and prime mover, transportation, handling and storage shall be given.

9.2 The following to be presented:

a) Descriptions;
b) Technical characteristics;
c) Diagram; and
d) Hazards and measures related to safety.

10 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

10.1 Basic Data for All Types of Immersion Vibrator

The following basic data shall be presented:

a) Diameter of vibration head (mm);
b) Length of vibration head (mm);
c) Mass of vibration head (kg);
d) Total mass of vibrator (kg);
e) Centrifugal force [kN (no load)];
f) Vibration frequency [Hz (no load)]; and
g) Double amplitude [mm (no load)].

10.2 Complementary Data for All Types of Immersion Vibrator

If available, the compaction diameter (mm) shall also be specified.

10.3 Complementary Data for Particular Immersion Vibrator Types and Associated Units

10.3.1 *Electric Immersion Vibrators with Flexible Drive*

For electric immersion vibrators, the following data shall also be presented:

a) Electric motor data:
    1) Motor type: Single or three-phase, synchronous, commutator;
    2) Rated power and current (kW, A);
    3) Voltage and frequency (V, Hz); and
    4) Revolutions (min^{-1}).
b) Overall dimensions:
    1) Length (mm);
    2) Width (mm); and
    3) Height (mm).
c) Flexible drive shaft length (metre).

10.3.2 Built-In Motor Type Electric Immersion Vibrators

For built-in motor type electric immersion vibrators, the following data shall also be presented:

a) Electric motor data:
    1) Motor type;
    2) Power and current (kW, A); and
    3) Voltage and frequency (V, Hz).
b) Overall length of the protective hose (metre);
c) Length of the hose-handle (metre); and
d) Hold part:
    1) Smooth protective hose with handling part; and

   2) Handle provided with on/off switch.

10.3.3 Frequency and Voltage Converter

For frequency and voltage converters, the following data shall also be presented:

a) Type of converter (single or three-phase);
b) Input voltage and frequency (V, Hz);
c) Output voltage and frequency (V, Hz);
d) Power and current (kW, A);
e) Number of output plug sockets; and
f) Overall dimensions:
   1) Length (mm);
   2) Width (mm);
   3) Height (mm); and
   4) Mass (kg).
g) Adaptation for handling: lifting structure or lifting structure and travelling axle.

10.3.4 Generating Set for Electric Supply

The following data on high and normal frequency generating set shall also be presented:

a) Internal combustion engine:
   1) Designation and name of manufacturer;
   2) Engine type:
      i) Spark ignition (two or four-cycle), or
      ii) Compression ignition.
   3) Power and revolutions (kW, min^{-1});
   4) Displacement (cm^3); and
   5) Mass (kg).
b) Generator:
   1) Output voltage and frequency (V, Hz);
   2) Power and current (kW, A); and
   3) Number of output plug sockets.
c) Total Mass (kg);
d) Overall Dimensions:
   1) Length (mm);
   2) Width (mm); and
   3) Height (mm).

10.4 Immersion Vibrators with Flexible Drive and Internal Combustion Engine

For immersion vibrators with flexible drive that have an internal combustion engine, the following data shall also be presented:

a) Internal combustion engine:
   1) Designation and name of manufacturer;
   2) Engine type:
      i) Spark ignition (two or four-cycle), or
      ii) Compression ignition;
   3) Power and revolutions (kW, min^{-1});
   4) Displacement (cm^3); and
   5) Mass (kg).
b) Length of a flexible drive shaft (metre).

10.5 Pneumatic Immersion Vibrators

For pneumatic immersion vibrators, the following data shall also be presented:

a) Maximum pressure (MPa);
b) Approx. frequency in concrete at nominal pressure (Hz);
c) Air consumption rate at nominal pressure (m^3/h); and
d) Length of a hose (m).

10.6 Hydraulic Vibrators

a) For hydraulic vibrators, the following data shall also be presented:
   1) Length of hose (m); and
   2) Length of a rigid part of the hose (mm).
b) Recommendations for the hydraulic power unit:
   1) Pump output (litre/min);and
   2) Maximum pressure (MPa).

11 MARKING

11.1 Each vibrator shall have firmly attached to it a mark plate bearing the following information:

a) Manufacturer’s name or trade-mark;
b) Vibrator reference number;
c) Type and rating of the power unit to be used;
d) Diameter (mm) of the vibrating needle;
e) Length (mm) of the vibrating needle;
f) Mass (kg) of the vibrating needle;
g) Year of manufacture; and
h) Frequency and amplitude.

11.2 BIS Certification Marking.

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Construction Plant and Machinery Sectional Committee, MED 18

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